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10/722,563	11/28/2003	Naoki Yoshimura	PTGF-03095	6265

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EXAMINER	
MONDT, JOHANNES P	
ART UNIT	**PAPER NUMBER**
3663	

DATE MAILED: 08/04/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/722,563	YOSHIMURA ET AL.	
	Examiner	Art Unit	
	Johannes P. Mondt	3663	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 May 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-5,13-16 and 18-27* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5, 13-16 and 18-27* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

Amendment filed 4/20/06 and Supplementary Amendment filed 5/24/06 (after Interview, see Interview Summary mailed 5/5/06) form the basis for this office action.

Applicants added new claim 27 in Amendment filed 4/20/06 and subsequently amended claims 1-5, 19 and 21-26. Comments in response to Remarks filed with said Amendment are included below under "Response to Arguments".

Specification

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

1. The specification is objected to because in the chemical composition formula on page 22, lines 21-27, both parameters "m" and "n", while quantified, are not defined: neither "m" nor "n" actually occur in said chemical composition formula. Said chemical composition formula should be replaced by an explicit formula in which the stoichiometric composition is unequivocally defined.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

1. ***Claims 1-5, 13, 19, 21, 23, 25 and 27*** are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In particular, the claim language "weight%" (line 8 of claim 1, lines 6-7 and 11-12 of claim 19, lines 8 and 12-13 of claim 27) of constituents comprised in a sialon system phosphor powder *comprised* in a rare-earth element doped oxide nitride phosphor leaves entirely indefinite which entity it is with respect to which said percentage is defined, the rare-earth element doped phosphor, sialon system phosphor powder, or the combination of α-sialon, β-sialon and un-reacted silicon nitride recited in the claim as constituents *comprised* in said sialon phosphor powder. This means that "weight%" is indefinite, rendering all claims dependent upon claims 1, 19 or 27 and claims 1, 19 and 27 indefinite.

1. ***Claims 14-16 and 18*** recite through claim 14, line 7, the limitation "x". There is insufficient antecedent basis for this limitation in the claim. A stoichiometric parameter is only definite if it defines a stoichiometric ratio of two definite material substances. There is no such ratio defined, either by chemical composition in which "x" features, nor in words.
2. ***Claims 20, 22 and 24*** recite the limitation "x". There is insufficient antecedent basis for this limitation in the claim. A stoichiometric parameter is only definite if it defines a stoichiometric ratio of two definite material substances. There is no such ratio defined, either by chemical composition in which "x" features, nor in words.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

1. ***Claims 1-5, 19, 21, 23 and 25*** are rejected under 35 U.S.C. 102(e) as being anticipated by Mitomo et al (6,632,379 B2). N.B.: This rejection is being offered subject to the noted indefiniteness under 35 USC 112, second paragraph, as delineated above. Weight percentages are assumed defined with regard to the sialon component of the phosphor powder only.

The applied reference has a common assignee and inventor with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

Mitomo et al teach a light emitting apparatus (title, abstract and columns 1-12, i.p. col. 5) comprising: a light emitting element with an emission wavelength in a range of 360 nm to 550 nm (column 1, line 62); and a rare earth element doped oxide nitride phosphor (see abstract), wherein a part of the light radiated from the light emitting

element is wavelength-converted by the phosphor (column 1, line 5 – column 2, line 46), and the phosphor comprises a sialon system phosphor powder comprising α-sialon of weight percentage (as ratio of total weight) in the range between 40 weight % to 90 weight % (Example 9, column 3, lines 21-30; column 11, lines 5-20 and abstract) (namely: 68 weight %), the α-sialon being structured such that a Ca site of Ca-α-sialon represented by $(Ca_xM_y)\ Si_{1-z1}Al_{z1}O_{1-z2}N_{z2}$ ($0\leq z_n\leq 1$, n=1,2) is partially replaced by metal (M) β-sialon of a weight % (as percentage of total phosphor weight) between 40% and 90% (namely: 68% (abstract and Example 9, column 11, line 5-20), and un-reacted silicon nitride of a weight % (as percentage of totals phosphor weight) of 30% or less, where M comprises metal that is one or more selected from Ce, Pr, Eu, Tb, Yb, and Er, namely: among Eu, Tb, Yb and Er, e.g., Eu (Example 9, column 11, lines 5-20) and $0.05 < (x+y) < 0.3$, $0.02 < x < 0.27$ and $0.03 < y < 0.3$ (namely: x=0.11 and y=0.06).

On claim 2: the emission wavelength is in the range of 450 nm to 550 nm (namely: 450 – 550 nm) (col. 1); and the light emitting apparatus radiates white light (col. 1, l. 5-15) generated by a mixture of the wavelength-converted light and an other part of light radiated from the light emitting element (the latter limitation being satisfied because inherently the probability of conversion for any single primarily excited photon is governed by Lambert's Law [see, e.g., M. Fukuda, "Optical Semcionductor Devices", Wiley Series in Microwave and Optical Engineering (1999), page 42], which is exponential).

On claim 3: the oxide nitride phosphor comprises an oxide nitride that contains the α-sialon as a matrix material (column 1, lines 14-20 and cols. 5-6).

On claim 4: the phosphor comprises a powder or particle (col. 3, l. 21-30) and is contained in a light transmitting material (as otherwise light could not be emitted by the phosphors as light output resulting in white light, the primary emission being in the blue/UV part of the spectrum.

On claim 5: the light-emitting element comprises a group II nitride system compound semiconductor light emitting element (column 1).

On claim 19: Mitomo et al teach a light-emitting method for a light-emitting apparatus that comprises a light emitting element with an emission wavelength in a range of between 360 to 550 nm (namely: 450 nm – 550 nm) and a rare earth element (among Eu, Tb, Yb, Er, e.g., Eu) doped oxide nitride phosphor wherein a part of the light radiated from the light emitting element is wavelength-converted by the phosphor (column 1, line 5 – column 2, line 46), and the phosphor comprises α - sialon system phosphor powder comprising α-sialon of weight percentage (as ratio of total weight) in the range between 40 weight % to 90 weight % (Example 9, column 3, lines 21-30; column 11, lines 5-20 and abstract) (namely: 68 weight %), the α-sialon being structured such that a Ca site of Ca-α-sialon represented by $(Ca_xM_y)\ Si_{1-z1}Al_{z1}O_{1-z2}N_{z2}$ ($0\leq z_n\leq 1$, n=1,2) is partially replaced by metal (M) β-sialon of a weight % (as percentage of total phosphor weight) between 40% and 90% (namely: 68% (abstract and Example 9, column 11, line 5-20), and un-reacted silicon nitride of a weight % (as percentage of totals phosphor weight) of 30% or less, where M comprises metal that is one or more selected from Ce, Pr, Eu, Tb, Yb, and Er, namely: Eu (Example 9, column

11, lines 5-20) and $0.05 < (x+y) < 0.3$, $0.02 < x < 0.27$ and $0.03 < y < 0.3$ (namely: $x=0.11$ and $y=0.06$).

On claim 21: The turn-on time inherently determines the temperature at which the light emitting apparatus operates during the later stage within said turn-on time, inherently so because of heat generation by ohmic heating and light emission. The band gap depends on temperature (see, for instance any textbook on semiconductor properties, or Ramirez-Flores et al, Phys. Rev. B50, 8433-8438, especially abstract). Hence the band gap depends on turn-on time. Because the color radiated from the light emitting apparatus depends on the emission spectrum of the light source and the emission spectrum of the light source depends on the band gap it follows that the color of the light radiated from the apparatus depends on the band gap and thereby on the temperature and thereby on the turn-on time. Since the further limitation is thus seen to be inherently met claim 22 is rejected over both alternatives.

On claim 25: the light emitting element comprises a III Group nitride system compound semiconductor emitting element (col. 1, l. 60-62).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. ***Claims 1 and 3-5*** are rejected under 35 U.S.C. 103(a) as being unpatentable over Ellens et al (US 2003/0052595 A1) (column 1, line 65 – column 2, line 17) in view of Asayama et al (JP 04021570).

On claim 1: Ellens et al teach ([0004]-[0041]) a light emitting apparatus (title, abstract) comprising: a light emitting element with emission wavelength in a range of 300 nm to 430 nm substantially overlapping the claimed range; see [0004]); and a rare-earth element doped oxide nitride phosphor ([0005]), wherein a part of the light radiated by the light-emitting element is wavelength converted by the phosphor (abstract), and the phosphor comprises a sialon system phosphor powder (see [0003] for definition of sialon as a-sialon by Ellens et al; [0012]; see [0031], first sentence, for "powder") represented by $Ca_xM_ySi_{1-y'}Al_{y'}O_{16-z}N_z$ where M comprises metal selected from Ce, Pr, Eu, Tb, Yb and Er, namely: Ce (see [0031]) with $x \leq 0.25$ and y= 10% of x, i. e, , thus meeting the claimed inequalities $0.05 < (x+y) < 0.3$ and $0.03 < y < 0.3$.

Ellens do not necessarily teach the limitation that said alpha sialon is partially replaced by metal-M β-sialon of 40 weight % or less and un-reacted silicon nitride of 30 weight % or less. However, it would have been obvious to include said limitation in view of Asayama et al, who teach to convert α-sialon to a mixture of α-sialon (cf. English abstract, "Constitution"), for instance of 75 weight % and β-sialon 25 weight % (Table 2) so as to increase mechanical strength and fracture toughness (see English abstract, "Purpose"). Furthermore, in the combined invention both crystal phases of sialon do inherently contain un-reacted silicon nitride, because the stoichiometric expressions prove that the majority of"(Si,Al)12(O,N)16", interpreted here as $Si_{1-a}Al_aO_bN_{1-b}$ units do

not contain Al and most of the latter do not contain any Ca nor Ce either, considering that that Si is present (a<1) while x+y is significantly less than 12. *Motivation* to include the teaching by Asayama et al in the invention by Ellens et al immediately follows from the improved mechanical strength and fracture toughness as recited by Asayama et al.

On claim 3: the oxide nitride phosphor comprises an oxide nitride that contains the α-sialon as a matrix material, matrix material being defined as the sialon with the Ce as luminescence center (loc.cit.).

On claim 4: the phosphor comprises a powder or particles and is containing in a light transmitting material (inherently so as otherwise light could neither reach the luminescence centers (Ce) nor leave the matrix material (the sialon) after having been wavelength-converted.

On claim 5: the light-emitting element comprises a III-group nitride system compound (see [0025]).

3. ***Claim 2*** is rejected under 35 U.S.C. 103(a) as being unpatentable over Ellens et al and Asayama et al as applied to claim 1 above, and further in view of Shimizu et al (5,998,925).

As detailed above, claim 1 is unpatentable over Ellens et al in view of Asayama et al. Neither Ellens et al nor Asayama et al necessarily teach the further limitation defined by claim 2. *However, it would have been obvious to include said further limitation in view of Shimizu et al,* to whom Ellens et al refer stating their LED is similar to the one taught by Shimizu et al, said LED by Shimizu et al emitting a primary radiation within the range of

400 nm – 530 nm (column 4, lines 43-49). Applicant is reminded that a *prima facie* case of obviousness typically exists when the ranges as claimed overlap the ranges disclosed in the prior art or when the ranges as claimed do not overlap but are close enough such that one skilled in the art would have expected them to have the same properties. In re Peterson, 65 USPQ2d 1379 (CA FC 2003).

4. ***Claims 14-16 and 18*** are rejected under 35 U.S.C. 103(a) as being unpatentable over Mueller et al (6,717,353 B1).

The following rejection is provided subject to the noted indefiniteness under 35 U.S.C. 112, second paragraph (see above), and with the interpretation explained in the rejection on the meaning of the stoichiometric parameter x to the best understanding of examiner.

Mueller et al teach a light emitting apparatus (see title), comprising: a light-emitting element with an emission wavelength in a range (comprising a blue and UV range [see column 1, lines 10-36 and abstract, final sentence], the blue range of the electromagnetic spectrum being between 455 nm and 492 nm; see Academic Press Dictionary of Science and Technology; see also the ultraviolet range, which also overlaps the range as claimed, namely: wavelengths less than about 380 nm; see again Academic Press Dictionary of Science and Technology) that substantially overlaps with the range (360 nm – 550 nm) as claimed; and a cerium-ion doped lanthanum silicon nitride phosphor (column 4, line 61 – column 5, line 22), wherein a part of light radiated from the light-emitting element is wavelength converted by the phosphor (column 4, line

64), a doping amount x ("x" here being interpreted as the stoichiometric ratio of cerium divided by the total stoichiometric parameter of cerium and (i.e., plus) lanthanum within said cerium-ion doped lanthanum silicon nitride), x being in the range between 0.01 and .5 (column 5, line 3: N.B.: "x" of applicant corresponds to a of Mueller et al, being the stoichiometric parameter defined above); said range for "x" thus substantially overlapping the range as claimed ($0.0<x<0.2$), while, to teach a range end points must be at least infinitesimally close to the invention as reduced to practice; hence Mueller et al at least teach one data point for said stoichiometric parameter known to correspond to an electron beam excitation phosphor, i.e., within the range $0.0 < x < 0.2$.

Applicant is reminded that a *prima facie* case *of obviousness* typically exists when the ranges of a claimed composition overlap the ranges disclosed in the prior art or when the ranges of a claimed composition do not overlap but are close enough such that one skilled in the art would have expected them to have the same properties. In re Peterson, 65 USPQ2d 1379 (CA FC 2003).

Finally, on the basis of the teaching of at least one embodiment with ax in the claimed range said phosphor, being a cerium-doped lanthanum silicon nitride phosphor, is an electron beam excitation phosphor at least according to the definition thereof in the specification.

On claim 15: said phosphor is represented by $La_{1-x}Si_xN5:_xCe$ (column 5, line 1 and line 3, Mueller's "a" being the relevant stoichiometric parameter as defined above as "x") where the doping amount x is $0< x < 1$ (loc.cit.), and cerium ion is doped to a

lanthanum site in a solid dissolution replacement (because otherwise "sites" such as for lanthanum do not exist).

On claim 16: a doping amount x is $0.1 < x < 0.5$ (column 5, line 3), and the phosphor comprises an UV excitation phosphor (UV light is emitted too from the light-emitting element (see abstract, final sentence and column 4, line 61 – column 5, line 6).

On claim 18: the phosphor by Mueller et al radiates blue light (column 4, line 64 – column 5, line 3).

5. ***Claims 19, 21 and 25*** are rejected under 35 U.S.C. 103(a) as being unpatentable over Ellens et al in view of Asayama et al and Yoneda (US 2004/0109302 A1).

Ellens et al teach ([0004]-[0041]) a light emitting method by obvious application of the light-emitting apparatus (title, abstract) comprising: a light emitting element with emission wavelength in a range of 300 nm to 430 nm substantially overlapping the claimed range; see [0004]); and a rare-earth element doped oxide nitride phosphor ([0005]), wherein a part of the light radiated by the light-emitting element is wavelength converted by the phosphor (abstract), and the phosphor comprises a sialon system phosphor powder (see [0003] for definition of sialon as a-sialon by Ellens et al; [0012]; see [0031], first sentence, for "powder") represented by $Ca_xM_ySi_{1-y'}Al_{y'}O_{16-z}N_z$ where M comprises metal selected from Ce, Pr, Eu, Tb, Yb and Er, namely: Ce (see [0031]) with $x \leq 0.25$ and y= 10% of x, i. e, , thus meeting the claimed inequalities $0.05 < (x+y) < 0.3$ and $0.03 < y < 0.3$.

Ellens do not necessarily teach the limitation that said alpha sialon is partially replaced by metal-M β-sialon of 40 weight % or less and un-reacted silicon nitride of 30 weight % or less. *However, it would have been obvious to include said limitation in view of Asayama et al,* who teach to convert α-sialon to a mixture of α-sialon (cf. English abstract, "Constitution"), for instance of 75 weight % and β-sialon 25 weight % (Table 2) so as to increase mechanical strength and fracture toughness (see English abstract, "Purpose"). Furthermore, in the combined invention both crystal phases of sialon do inherently contain un-reacted silicon nitride, because the stoichiometric expressions prove that the majority of"$(Si,Al)_{12}(O,N)_{16}$", interpreted here as $Si_{1-a}Al_aO_bN_{1-b}$ units do not contain Al and most of the latter do not contain any Ca nor Ce either, considering that that Si is present (a<1) while x+y is significantly less than 12. *Motivation* to include the teaching by Asayama et al in the invention by Ellens et al immediately follows from the improved mechanical strength and fracture toughness as recited by Asayama et al.

Neither Ellens et al nor Asayama et al necessarily teach the further limitation of turning on intermittently the light emitting element. *However, it would have been obvious to include said limitation in view of Yoneda et al,* who teach the application of white light emitting elements to plant cultivation methods. *Motivation* to include the teaching by Yoneda et al in the invention by Ellens et al least derives from the obvious application of the method of using a light emitting element by Ellens et al to plant cultivation, given the output of white light by the method of Ellens et al (see [0001] in Ellens et al)).

*On claim 21:*The turn-on time inherently determines the temperature at which the light emitting apparatus operates during the later stage within said turn-on time,

inherently so because of heat generation by ohmic heating and light emission. The band gap depends on temperature (see, for instance any textbook on semiconductor properties, or Ramirez-Flores et al, Phys. Rev. B50, 8433-8438, especially abstract). Hence the band gap depends on turn-on time. Because the color radiated from the light emitting apparatus depends on the emission spectrum of the light source and the emission spectrum of the light source depends on the band gap it follows that the color of the light radiated from the apparatus depends on the band gap and thereby on the temperature and thereby on the turn-on time. Since the further limitation is thus seen to be inherently met claim 22 is rejected over both alternatives.

:On claim 25: the light emitting element by Ellens et al comprises a group III nitride system compound semiconductor light emitting element.

6. ***Claims 20, 22 and 26*** are rejected under 35 U.S.C. 103(a) as being unpatentable over Mueller et al (6,717,353 B1) in view of Yoneda et al (US 2004/0109302 A1), and, in the alternative, over Ellens et al (US 2003/0052595 A1) in view of Yoneda et al (US 2004/0109302 A1).

<u>Mueller et al</u> *teach* a light-emitting method for a light-emitting apparatus that comprises a light-emitting element with an emission wavelength in a range comprising blue and UV, hence at least the blue range, which is at least the range from 455 nm to 492 nm; see Academic Press Dictionary of Science and Technology; N.B.: the ultraviolet (UV) range also overlaps with the range as claimed, being defined as wavelengths bordering 380 nm from below; loc.cit.) that at least substantially overlaps with the range of 360 nm –550 nm as claimed, and a cerium-ion doped lanthanum

silicon nitride phosphor (col. 4, line 61 – column 5, line 3), wherein part of the light radiated from the light emitting element is wavelength-converted by the phosphor (column 4, line 64), a doping amount "x" satisfies $0.01 < x < 0.5$ thus substantially overlapping with the range defined by the double inequality $0.0 < x < 0.2$ as claimed (column 5, line 3), the phosphor comprises an electron beam excitation phosphor (by virtue of satisfying substantial overlap with the stoichiometric range admitted by applicant as defining electron beam excitation phosphor, and the light emitting apparatus radiates light generated from a mixture of wavelength-converted light (column 4, line 61 – column 5, line 21) and another part of light radiated from the light emitting element (the latter limitation being satisfied because inherently the probability of conversion for any single primarily excited photon is governed by Lambert's Law [see, e.g., M. Fukuda, "Optical Semcionductor Devices", Wiley Series in Microwave and Optical Engineering (1999), page 42], which is exponential).

Mueller et al do not necessarily specifically teach the limitation "turning the light emitting on intermittently". However, it would have been obvious to include said limitation in view of Yoneda et al, who teach the application of white light emitting elements to plant cultivation methods.

Motivation to include the teaching by Yoneda et al in the invention by Mueller et al at least derives from the obvious application of the method of using a light emitting element by Mueller et al to plant cultivation, given the output of white light by the method of Mueller et al (see abstract in Mueller et al).

Ellens et al teach a light-emitting method for a light-emitting apparatus that comprises a light-emitting element with an emission wavelength in a range that substantially overlaps with the range as claimed, namely the range at least comprising the range from 380 nm to 420 nm; loc.cit.), and a cerium-ion doped lanthanum silicon nitride phosphor ([0005])), wherein part of the light radiated from the light emitting element is wavelength-converted by the phosphor ([0005]), a doping amount "x" being 0.5 to 15% of total metal, hence considering the range of p thus substantially overlapping with the range defined by the double inequality $0.0 < x < 0.2$ as claimed, the phosphor comprises an electron beam excitation phosphor (by virtue of satisfying substantial overlap with the stoichiometric range admitted by applicant as defining electron beam excitation phosphor, and the light emitting apparatus radiates light generated from a mixture of wavelength-converted light and another part of light radiated from the light emitting element (the latter limitation being satisfied because inherently the probability of conversion for any single primarily excited photon is governed by Lambert's Law [see, e.g., M. Fukuda, "Optical Semcionductor Devices", Wiley Series in Microwave and Optical Engineering (1999), page 42], which is exponential).

On claim 22: The turn-on time inherently determines the temperature at which the light emitting apparatus operates during the later stage within said turn-on time, inherently so because of heat generation by ohmic heating and light emission. The band gap depends on temperature (see, for instance any textbook on semiconductor properties, or Ramirez-Flores et al, Phys. Rev. B50, 8433-8438, especially abstract).

Hence the band gap depends on turn-on time. Because the color radiated from the light emitting apparatus depends on the emission spectrum of the light source and the emission spectrum of the light source depends on the band gap it follows that the color of the light radiated from the apparatus depends on the band gap and thereby on the temperature and thereby on the turn-on time. Since the further limitation is thus seen to be inherently met claim 22 is rejected over both alternatives.

On claim 26: the light emitting apparatus by Mueller et al comprises a group III nitride system compound semiconductor emitting element (see their claim 14, for instance); similarly, the light emitting apparatus by Ellens et al comprises a group III compound semiconductor emitting element ([0002]).

7. ***Claim 23*** is rejected under 35 U.S.C. 103(a) as being unpatentable over Ellens et al, Asayama and Yoneda as applied to claim 19 above, and further in view of Shimizu et al (5,998,925).

As detailed above, claim 19 is unpatentable over Ellens et al in view of Asayama et al and Yoneda. Neither Ellens et al nor Asayama et al nor Yoneda necessarily teach the further limitation defined by claim 23. *However, it would have been obvious to include said further limitation in view of Shimizu et al,* to whom Ellens et al refer stating their LED is similar to the one taught by Shimizu et al, said LED by Shimizu et al emitting a primary radiation within the range of 400 nm – 530 nm (column 4, lines 43-49). Applicant is reminded that a *prima facie* case of obviousness typically exists when the ranges as claimed overlap the ranges disclosed in the prior art or when the ranges as claimed do not overlap but are close enough such that one skilled in the art would have

expected them to have the same properties. In re Peterson, 65 USPQ2d 1379 (CA FC 2003).

8. ***Claim 24*** is rejected under 35 U.S.C. 103(a) as being unpatentable over Mueller et al (6,717,353 B1) in view of Yoneda et al (US 2004/0109302 A1).

With reference to the rejection overleaf of claim 20 over Muller et al in view of Yoneda et al, Mueller teach the emission wavelength to be in the range blue and UV, hence at least the blue range, which is at least the range from 455 nm to 492 nm; see Academic Press Dictionary of Science and Technology; N.B.: the ultraviolet (UV), for which at least the extremities 455 and 492 are disclosed by Mueller, both of which falling in the range as claimed (450 – 550 nm); while the light emitting apparatus by Mueller et al radiates white light (col. 4 in particular, and loc.cit.).

Response to Arguments

Applicant's arguments filed 4/20/06 have been fully considered but they are not persuasive.

Applicant alleges parameters m and n are defined in the specification on line 25 of page 20. This is not persuasive because only values are given in line 25, page 20.

Applicant alleges that β-sialon is defined by lines 20-23 of page 20. This definition is strictly adhered to in this office action. Accordingly, the wording as newly amended in claim 1 means that a Ca site of Ca-a-sialon represented by $(Ca_x, M_y)(Si,Al)_{12}(O,N)_{16}$ is partially replaced by metal M; and the β-sialon recited is

simply the β-sialon without any metal added to, i.e., as defined on lines 20-23 of page 20.

On claim objections:

Applicants, in response to the objection, allege that "anyone of ordinary skills in the art would clearly understand this claim language" and request an explanation how "*any* confusion would thereby arise". Applicants merely ask the rhetorical question how any confusion could arise but do not further delineate what they mean by "weight%". In response applicants are respectfully reminded that the phosphor is claimed only to *comprise* a sialon system that in its turn is only claimed to *comprise* phosphor powder, which again in its turn is claimed to comprise the components α-sialon, β-sialon and un-reacted sialon. Therefore, confusion can indeed arise because the percentage in "weight%" may be defined with respect to the phosphor, the sialon phosphor powder, or exclusively the specifically claimed components. Therefore, the traverse is not persuasive. In "light" of applicants' response to the claim objection further confusion reigns, and examiner has no choice but to present a rejection for indefiniteness (112, second paragraph) instead.

On rejection under 35 USC 112, second paragraph:

With regard to the rejection of claims 1-5, 13, 19 and 21-26, it has been successfully removed by amendment.

With regard to the rejection of claims 14-16 and 18, and also the rejection of claim 20 under 112, second par., applicant's argument that "a doping amount x" "clearly has proper antecedent basis structure" fails to persuade, because both doping amount

and fraction are introduced at the same time while "a doping amount" does not at all state with respect to which denominator said amount is defined as a fraction, and does not state which substance is being doped into which other material. Therefore traverse is not persuasive and the rejections stand.

With regard to the traverse of the rejection of claims 1-5 over Mitomo:

Applicants allege Mitomo does not teach a LED. This is not persuasive because as stated by Mimoto "the present invention has been made in view of the above circumstances" (col. 2, l. 13-15), and it is an object of the present invention to provide an oxynitride phosphor activated by a rare earth element, which makes high luminance of a white light emitting diode (LED) employing a blue light emitting diode (blue LED) as a light source possible". The "above circumstances" precisely refer to the circumstance that "a phosphor suitable for such white LED" (col. 1, l. 64) has the drawback that it has (col. 2, l. 1-12), and "such white LED" precisely and exclusively refers to the white LED with wavelength from 450 to 550 nm a light source (col. 1, l. 62 as cited in the action). Mimoto et al thus teach not just a phosphor, but instead teach a phosphor for a LED with light source in the indicated wavelength range of 450 – 550 nm which falls entirely in the range as claimed (360 – 550 nm). This is THE goal of the invention by Mitomo et al, pertaining to all examples.

Applicants further allege that the Example 11 has a light emission of 550-650 nm. This argument is not correct because said light emission is the light emission as a whole, but instead the light emission of the light emitted element of the light emitting apparatus.

Applicant further allege that the Example 9 has an emission between 550 and 650 nm, but this is incorrect for the same reasons.

In conclusion on Mimoto et al , none of the arguments in traverse are persuasive and the rejection stands.

With regard to the rejection of claims 1 and 3-5 over Ellens:

Applicants allege that the plain meaning of the claim language is not satisfied by having a range substantially overlapping the claimed range" (light emitting element with an emission wavelength in a range of 360 to 550 nm) and that "Applicants are entitled to assert that their invention improves white light by providing the entire precisely-defined emission range of the apparatus" (page 13). This is not persuasive because the claim language does not say so: it only claims "a light emitting element with an emission wavelength in a range of 360 to 550 nm" Ellens et al clearly have a wavelength in said range, namely 430 nm.

Applicants argue furthermore that the second reference does not teach or suggest the mechanism of the present invention of controlling the pulse of the light source relative to the emission of the phosphor color". However, this argument is not persuasive because Asayama et al was not cited therefor, but instead was only cited for the partial replacement of α-sialon. A clear motivation was provided (mechanical strength and fracture toughness, with reference to Asayama et al (English abstract). Applicants do not even comment on said motivation to combine the references.

Therefore, all arguments in traverse of the rejection of claims 1-3 and 5 over Ellens stand.

With regard to the rejection over Shimizu et al:

Applicants' argument does not address the ground of the rejection, which is the argument of at least overlapping range as presented overleaf.

With regard to the comment on the Asayama reference:

Applicants' argument that "the sintered compact of Asayama does not have any luminescence property is not persuasive, because it is incorrect: the luminescence resides in the metal addition, which is present even without introducing the metal-M b-sialon, while the crystallographic properties are unrelated to the luminescence because the photon interacts locally.

With regard to the rejection based on Mueller:

Applicants allege "the same deficiency identified above for Ellens exists for Mueller in the entire, precisely defined range of emission of the claimed invention is conceded by the examiner as not being present in Mueller. However, again applicants misinterpret their own claim language because the limitation "the emission wavelength is in the range of 360 to 550 nm" does not claim the entire, precisely defined range of emission to be covered, which is what applicants seem to imply. Clearly, an emission wavelength in the claimed range is enough to meet the claim.

Applicants allege that Mueller fails to disclose whether its phosphor is alpha or bet sialon; however, the claim language of claims 14-16 is silent on this. Therefore, the arguments in traverse of the rejection over Mueller are not persuasive and the rejection stands.

With regard to the Double Patenting Rejection:

Applicants' traverse has prompted reconsideration and withdrawal of the double patenting rejection at least because Eu and Pr are not included in the metals M in Mitomo et al and they are included in the metal M in claims 1 and 13.

The present office action is not made final only because the correct range by wavelength range by Ellens has 430 nm as upper limit, not 485 nm (however, 430 nm is in the range as claimed for claims 1 and19 (360 – 550 nm) and hence meets the claim limitations) while it occurs to examiner that the further limitations defined by claims 21 and 22 are inherently satisfied given the rise in temperature due to heating during the ON-time and the consequent shift in band gap with inherent shift in the emission spectrum (with reference to any textbook or Ramirez-Flores et al as cited above).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Johannes P. Mondt whose telephone number is 571-272-1919. The examiner can normally be reached on 8:00 - 18:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jack W. Keith can be reached on 571-272-6878. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JPM
July 31, 2006

Patent Examiner:

Johannes Mondt (Art Unit: 3663)